

DISCUSSION

EARTHQUAKE GROUND MOTION CHARACTERISTICS AND SEISMIC ENERGY DISSIPATION¹

DISCUSSION BY MARIO E. RODRIGUEZ

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The writer would like to make some comments on the paper by Sucuoglu and Nurtug.¹ In the paper the authors erroneously relate equation (7) to the parameter proposed by the writer for measuring the severity of an earthquake ground motion,² I_D . Assuming that the authors intended instead to relate the parameter I_D to the parameter N defined in equation (8), it follows that they are misunderstanding the meaning of I_D . Not only the denominators of I_D and N are different, as suggested in the paper, but also the numerators of both parameters. While the numerator of N is equal to E_H , see equation (8), the numerator of I_D is equal to $\gamma^2 E_H/m$, where γ is defined as

$$\gamma = \frac{\delta}{u} \quad (1)$$

In equation (1) δ is the roof displacement relative to the ground of a multistorey building, and u is the relative displacement with respect to the ground of a SDOF system.² Although I_D is related to a hysteretic energy dissipation during an earthquake, it seems that the authors have not noticed that I_D is also related to the maximum roof displacement of a multistorey building during an earthquake. Furthermore, since I_D is directly proportional to building displacement squared, the use of I_D points out the importance of controlling building displacements for minimizing seismic damage.²

While it is true, as stated by the authors, that an earthquake ground motion with a given damage potential may cause different levels of damage on different systems, owners and engineers are mostly interested in reducing seismic damage in structures. Therefore, the authors statement that damage potential should be independent of system characteristics might be debatable. Moreover, the large number of damaged or collapsed structures during recent earthquake shows that there is an urgent need for defining an adequate measure of damage potential related to structural system characteristics.

The authors have also raised an issue on damage potential that should be commented. In their opinion a damage potential for earthquakes that takes into account resistance capacity and ductility level of all inelastic SDOF systems is not practical. However, the use of the parameter I_D shows the contrary.^{2,3} Furthermore, an interesting finding when using I_D is that rather than being strongly dependent on resistance capacity or ductility level, the results are mainly dependent on building displacements.

Regarding the authors' parameter, E_I , it has been shown that the Housner intensity, I_H , is not a reliable measure of earthquake intensity.^{3,4} Therefore, the strong correlation shown in the paper between the parameters E_I and I_H might suggest that E_I is not a reliable measure of earthquake intensity either.

REFERENCES

1. H. Sucuoğlu and A. Nurtuğ, 'Earthquake ground motion characteristics and seismic energy dissipation', *Earthquake eng. struct. dyn.* **24**, 1195–1213 (1995).
2. M. Rodriguez, 'A measure of the capacity of earthquake ground motion to damage structures', *Earthquake eng. struct. dyn.* **23**, 627–643 (1994).
3. M. Rodriguez and J. C. Aristizabal, 'Evaluation of seismic destructiveness', in *Proc. IIWCEE*, Acapulco, Mexico, 1996.
4. C. Uang and V. Bertero, 'Implications of recorded earthquake ground motions on seismic design of building structures', *Report No. UCB/EERC 88/13*, Earthquake Engineering Research Center, University of California, Berkeley, CA, 1988.